

BIOMEDICAL ENGINEERING

OVERVIEW

Department website: <https://www.uvm.edu/cems> (<https://www.uvm.edu/cems/>)

OVERVIEW

The University of Vermont (UVM) offers interdisciplinary graduate programs in Biomedical Engineering that leverage core strengths in engineering and collaborations with researchers across campus, including those in UVM's Lerner College of Medicine.

The M.S. in Biomedical Engineering gives students the opportunity to develop advanced engineering skills and domain expertise so that they may apply engineering methods to address problems related to human health. Students enrolled in the M.S. in BME program pursue a 2-year, personalized plan of study that includes only coursework, a project, or a research-oriented thesis. Students who complete their undergraduate studies at UVM may complete the M.S. in BME coursework in 1 year through an Accelerated Master's Program (AMP).

The Ph.D. in Biomedical Engineering is a flexible, dynamic degree that trains aspiring researchers to apply engineering techniques to the study of biological systems. Research areas include bioinstrumentation, biomechanics, biomedical imaging, biomedical systems and signal analysis, clinical engineering, digital health, implant design, rehabilitation engineering, simulation and modeling, biomaterials, tissue engineering, and biomathematics.

DEGREES

Biomedical Engineering AMP (<http://catalogue.uvm.edu/graduate/biomedicalengineering/biomedicalengineeringamp/>)

Biomedical Engineering M.S. (<http://catalogue.uvm.edu/graduate/biomedicalengineering/biomedicalengineeringms/>)

Biomedical Engineering Ph.D. (<http://catalogue.uvm.edu/graduate/biomedicalengineering/biomedicalengineeringphd/>)

FACULTY

Bates, Jason H. T.; Professor, Department of Medicine-Pulmonary; DSC, Canterbury University; PHD, University of Otago

Berger, Christopher Lewis; Professor, Department of Molecular Physiology and Biophysics; PHD, University of Minnesota Twin Cities

Beynon, Bruce David; Professor, Department of Orthopaedics and Rehabilitation; PHD, University of Vermont

Cipolla, Marilyn Jo; Professor, Department of Neurological Sciences; PHD, University of Vermont

Doiron, Amber; Assistant Professor, Department of Electrical and Biomedical Engineering; PHD, University of Texas at Austin

Dubief, Yves C.; Associate Professor, Department of Mechanical Engineering; PHD, Institut National Polytechnique de Grenoble

Fiorentino, Niccolo M.; Assistant Professor, Department of Mechanical Engineering; PHD, University of Virginia

Jangraw, David; Assistant Professor, Department of Biomedical Engineering, PHD, Columbia University

McGinnis, Ryan S.; Assistant Professor, Department of Electrical and Biomedical Engineering; PHD, University of Michigan

Oldinski-Floreani, Rachael Ann; Associate Professor, Department of Mechanical Engineering; PHD, Colorado State University

Rizzo, Donna Marie; Professor, Department of Civil and Environmental Engineering; PHD, University of Vermont

Spector, Peter Salem; Professor, Department of Medicine-Cardiology; MD, Albert Einstein College of Medicine

Warshaw, David; Professor, Department of Molecular Physiology and Biophysics; PHD, University of Vermont

Weiss, Daniel; Professor, Department of Medicine-Pulmonary; MD, PHD, Mount Sinai School of Medicine

Courses

BME 201. Biomaterials Engineering. 3 Credits.

A materials science and engineering approach is used to explore the structure-function relationships of natural and bio-inspired materials for various engineering applications. The emphasis is on mechanical design and function. The medical applications of biomaterials will be discussed. Prerequisites: ME 101 or BME 112. Cross-listed with: ME 201.

BME 204. Biothermodynamics. 3 Credits.

Inter-disciplinary; guides the student through the thermodynamics of living organisms, comprised of the study of energy transformation in the life sciences. Designed for students from the STEM disciplines. Covers Gibbs free energy, statistical thermodynamics, binding equilibria, and reaction kinetics. Prerequisites: ME 123, ME 124, or BME 112. Cross-listed with: ME 204.

BME 206. Biomechanics of Human Motion. 3 Credits.

Biomechanics of Human Motion will describe the typical processes-from small scale protein interactions to large scale joint torques-that result in human locomotion. Clinical problems and athletic performance will be discussed. Students will learn about musculoskeletal tissues related to force generation/transmission and will perform kinematic/kinetic analyses. Prerequisite: BME 011 or ME 012. Pre/Co-requisites: ME 101, ME 111, or BME 111. Cross-listed with: ME 206.

BME 208. Biomechanics: Tissue Engr. 3 Credits.

Solid biomechanics including structure, function and mechanical properties of biological tissues. Tissue engineering involving cell mechanics, scaffold materials, and signaling. Current literature topics are covered. Prerequisites: ME 101 or BME 112. Cross-listed with: ME 208.

BME 227. Biomedical Instrumentation. 3 Credits.

Measurement techniques for biomedical engineering research and industry, and health care institutions. Integrated biomedical monitoring, diagnostic, and therapeutic instrumentation. Prerequisite: EE 100 or EE 004 or EE 075 or EE 021. Co-requisite: EE 120, ANPS 020, or Instructor permission. Cross-listed with: EE 227.

BME 229. Biosignal Decoding. 3 Credits.

Overview of biomedical measurement techniques; development of Python software to visualize, denoise, and decode biomedical signals. Prerequisites: CS 021; (BME 111 or EE 171) or (ME 111 and EE 101) or Instructor permission. Pre/Co-requisites: Beginner knowledge of Python programming is strongly suggested. Cross-listed with: EE 229.

BME 240. Wearable Sensing. 3 Credits.

Covers current state-of-the-art in wearable sensors and the biomechanical and physiological phenomena they are being used to measure. Emphasis will be given to applications related to human health and medicine. Prerequisite: ME 111 or EE 171 or equivalent with Instructor permission.

BME 241. Biomedical Signal Processing. 3 Credits.

Covers several important physiological signals often monitored in biomedical contexts (e.g. EMG, ECG, PPG). Content will include the physiology that generates the signals as well as the signal processing techniques (e.g., LTI filters, empirical mode and wavelet decomposition) and algorithms used for analysis. Prerequisite: ME 111 or EE 171 or equivalent with Instructor permission.

BME 250. Nanobiomaterials. 3 Credits.

Covers the classes of nanomaterials used biomedically, the biological response, and material testing. Content includes applications of nanomaterials in drug delivery, nano-topography of surfaces, sensors, and imaging as well as the topic of nanotoxicity. Pre/Co-requisites: ME 101, BME 111, or equivalent with Instructor permission.

BME 391. Master's Thesis Research. 1-18 Credits.

Credit as arranged.

BME 392. Independent Study. 1-18 Credits.

A course which is tailored to fit the interests of a specific student, which occurs outside the traditional classroom/laboratory setting under the supervision of a faculty member, for which credit is awarded. Offered at department discretion.

BME 393. Graduate Seminar. 1 Credit.

Presentation and discussion of advanced problems, research, and current topics in Electrical Engineering by faculty, graduate students, and outside guest speakers. Prerequisite: Graduate Student standing.

BME 394. Independent Graduate Research. 1-18 Credits.

Graduate student work on individual or small team research projects under the supervision of a faculty member, for which credit is awarded. Offered at department discretion.

BME 396. Advanced Special Topics. 1-18 Credits.

See Schedule of Courses for specific titles.

BME 491. Dissertation Research. 1-18 Credits.**BME 492. Independent Study. 1-18 Credits.**

A course which is tailored to fit the interests of a specific student, which occurs outside the traditional classroom/laboratory setting under the supervision of a faculty member, for which credit is awarded. Offered at department discretion.

BME 494. Independent Graduate Research. 1-18 Credits.

Graduate student work on individual or small team research projects under the supervision of a faculty member, for which credit is awarded. Offered at department discretion.

BME 496. Advanced Special Topics. 1-18 Credits.

See Schedule of Courses for specific titles.